



**U.S. Department of Energy  
Energy Efficiency and  
Renewable Energy**

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## INDUSTRIAL TECHNOLOGIES PROGRAM

# Hemicellulose Extraction and its Integration in Pulp Production

## Extraction of Hemicellulose Prior to Pulping Promises to Increase Pulp Production Efficiency

The majority of wood is pulped by the kraft chemical pulping process. This process does a good job of liberating the cellulose fibers from which paper is made, but it is a low-yield process since most of the hemicellulose and almost all of the lignin components of the wood are dissolved into the spent pulping liquor. This “black liquor” is processed downstream in a recovery boiler – which burns the organics in the black liquor to produce process steam and recovers the inorganic cooking chemicals for re-use. Because lignin has a relatively high heating value, it is cost-effective to recoup the heating value by

combustion. The hemicelluloses, however, have a low heating value and are not most cost-effectively used through this process. Extracting the hemicellulose from wood chips prior to pulping could be used to increase pulp yield and production and/or produce higher value chemicals and polymers.

### Project Description

The goal of this project is to develop processes for extracting hemicelluloses from residual wood chips during pulp production, redepositing the extracted oligomers onto the pulp to improve yield.



*Profiling digester system used for pre-extraction of wood chips.*



### Benefits for Our Industry and Our Nation

Extracting the hemicellulose from the wood chips prior to pulping and depositing the oligomer portion onto the pulp stream after the digester could increase pulp yield by 2 percent, resulting in approximately \$600 million a year in extra pulp production.

### Applications in Our Nation's Industry

Hemicellulose extraction could be used by all U.S. pulp mills using the kraft pulping processes.

### Project Partners

The University of Maine  
Orono, ME

International Paper Company  
Tuxedo, NY

## Pathways/Milestones

- Extraction of softwood and hardwood residual chips
- Modified kraft cooking of pre-extracted residual wood chips
- Redeposition of hemicelluloses onto the pulp produced through kraft cooking
- Oxygen delignification of the kraft pulp with the deposited hemicelluloses
- Bleaching of the oxygen delignified pulp

## Commercialization

Successful development and demonstration of these processes will lead to initial implementation at an International Paper Company (IP) mill, using conventional and the newly developed technology.

## For additional information, please contact:

Drew Ronneberg, Ph.D.  
Industrial Technologies Program  
Phone: (202) 586-0205  
Fax: (202) 586-9234  
E-mail: [Drew.Ronneberg@ee.doe.gov](mailto:Drew.Ronneberg@ee.doe.gov)

Adriaan van Heiningen, Ph.D.  
The University of Maine  
Orono, ME  
Phone: (207) 581-2278  
Fax: (207) 581-2323  
E-mail: [avanheiningen@umche.maine.edu](mailto:avanheiningen@umche.maine.edu)

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